PATENT SPECIFICATION 912,637

DRAWINGS ATTACHED.

Inventor:—ROWLAND JOHN JAMES DE COURCY.

Date of filing Complete Specification : June 3, 1960.

Application Date : March 4, 1959. No. 7612/59.

Complete Specification Published : Dec. 12, 1962.

Index at Acceptance :—**Class 78(1), A(1H6 : 4).**

International Classification : – **B65g.**

COMPLETE SPECIFICATION.

Conveyor Apparatus.

We, ROWNSON CONVEYORS LIMITED (formerly known as Rownsons (Conveyors) Limited), a British Company, of Maiden Lane, York Way, London, N.7, and formerly of 9 Broken Wharf, Upper Thames Street, London, E.C.4, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to conveyor apparatus for feeding articles such as, for instance, parcels and packages and it has, as its principal object, the provision of apparatus, the use of which enables the feeding of the articles being handed to be controlled in a simple and effective manner.

The present invention consists in article-feeding apparatus comprising a roller conveyor having conveyor rollers which are adapted to be rotatably driven so as to convey articles supported thereby, means for delivering articles to said rollers for conveyance thereafter and cyclically operating means for driving the rollers selectively and intermittently in such a way that an article or articles delivered to the rollers at the commencement of each operating cycle is or are fed forwardly by the rollers, while an article or articles subsequently delivered by the delivery means to the rollers is not or are not fed until the commencement of the next operating cycle.

In one form of article-feeding apparatus which will be described in greater detail hereinafter, each operating cycle of the driving means consists in the application of driving power to all the rollers simultaneously, followed by the removal of driving power first from the roller nearest the delivery means and then from the remaining rollers in sequence. With this arrangement, an article or articles which has or have previously been delivered to the rollers by the delivery means and is or are already supported by the rollers when driving power is applied is or are fed forwardly and discharged from the apparatus, while an article or articles delivered by the supply means subsequently to the commencement of the sequential removal of driving power is or are retained until the next occasion upon which driving power is applied to all the rollers.

Such an arrangement makes it possible to effect continuous control of the rate at which the articles handled are fed onwards, the rate of feeding being readily variable merely by altering the timing of the driving cycle.

Thus such apparatus may be used, for example, for accumulating articles derived from an erratic source and feeding them onward at regular intervals in time so as to render the rate of supply uniform. Alternatively, the apparatus may be used for accumulating single articles and feeding them onwardly in batches at predetermined time-intervals.

According to another feature of our invention, there is provided a conveyor installation comprising a conveyor, two article-feeders of the kind referred to above, arranged so as to feed articles to the conveyor at points spaced from one another along the length thereof, and means controlling the cyclic driving means of the two feeding apparatus, so that articles or batches of articles fed by the latter to the conveyor together form on the said conveyor, a stream of articles or batches of articles, derived

alternately from one and the other of the said feeding apparatus.

In order that the invention may be clearly understood, one such installation, which is intended for mixing in a single stream, batches of parcels or packages derived alternately from one and the other of two packaging machines, will now be described more fully with reference to the accompanying drawings.

In the drawings:—

Figs. 1 and 2 are, respectively, plan and side elevational views of the said installation, drawn somewhat diagrammatically;

Fig. 3 is a sectional view on the line III—III in Fig. 1;

Fig. 4 is a side view of one of the article-feeders, constructed in accordance with the invention, which form part of the installation shown in Figs. 1 and 2, the feeder being shown partly in elevation and partly in section on the line IV—IV in Fig. 5;

Fig. 5 is a sectional view on the line V—V in Fig. 4; and

Fig. 6 shows diagrammatically, control apparatus which forms part of the installation.

Referring first to Figs. 1 and 2, a combined stream of packages derived in this construction from two packaging machines (not shown) is formed on the ascending upper flight A of an inclined endless-belt conveyor B, packages derived from the two packaging machines being fed to the conveyor B at two points C and D spaced from one another along the upper flight A. Thus, the point of feed D is at a higher vertical level than the point C.

The packages are discharged from the packaging machines horizontally, in directions which are parallel to one another and perpendicular to the direction of movement of the belt-conveyor B, as is indicated by the arrow *f* in Fig. 1. However, each packaging machine has associated with it a curved conveyor section or bend E or F, which serves to turn through 90° the direction of movement of the packages supplied by the packaging machine, ready for delivery to the main belt-conveyor B. As can be seen from Figs. 1 and 3 each conveyor bend E or F comprises transverse slats 101 which are connected by means of two circulating chains 102 and 103. The chain 102 comprises the same number of links as the chain 103, but its links are longer and the sprocket wheels 105 and 106 about which it is trained are of larger diameter than the sprockets 107 and 108 about which the chain 103 is trained. Thus the slats 101 are driven around an endless path, such that the slats in the upper run of the path extend fanwise around a quadrant of a circle, so as to effect the desired deflection of the direction of movement of the packages. Each slat 101 is guided along its curved path by rollers 110 and 111 co-operating with fixed guide rails 112 and 113.

Between each conveyor bend E or F and the corresponding point of delivery C or D to the main conveyor B there is provided an intermittently operating feeder unit G or H, Figs. 1 and 2. When either feeder unit G or H is operative it discharges a batch of accumulated packages to the main conveyor B, the timing of the operation of the respective feeders G and H being such that, beyond the second or higher point of delivery D to the belt-conveyor B, the stream of packages on the conveyor B consists of batches of packages originating alternately from one and the other packaging machine.

The first feeder G is conveniently arranged to deliver batches of packages to the main conveyor B at the lowest point of the ascending upper flight A of the conveyor B. The other feeder unit H, delivering its batches of packages at the higher level, feeds them to the conveyor B over a hinged flap J. The flap J comprises a frame 120 hinged at 121 to the main-frame 124 of the feeder H. The frame 120 is fitted with a set of idler rollers 122. Normally, the free edge 123 of the flap J is in contact with the belt B, as indicated in full lines in Fig. 2, and thus provides a ramp for the passage of packages from the feeder H to the conveyor B. However, when a batch of packages P, which has been delivered to the conveyor B at the lower level by the feeder G reaches this second delivery point D, these packages can push the flap J upwardly, into the position shown in dotted lines in Fig. 2, so as to allow themselves to pass.

Between the discharge end of each conveyor bend E or F and the input end of its associated feeder G or H, there is a number of driven rollers which serve to support packages in transit between the conveyor bend and the feeder. In the case of the conveyor bend F and the feeder H, these driven rollers are shown at K in Fig. 4.

The construction of the feeder H will now be described in greater detail, the construction of the feeder G being similar. As can be seen from Figs. 4 and 5, the feeder H includes conveyor rollers 1, each of which is freely rotatable about a spindle such as 2. The various spindles 2 are mounted in frame-members 3 and 4 and extend transversely of the direction of discharge of the packages Q to the feeder H from the associated conveyor bend F. The frame-member 3 is formed with a series of spaced circular holes 5, in each of which the end portion 2*a* of one of the roller-spindles 2 is engaged. The other side-member 4 is formed with a series of spaced notches 6, open at their upper ends, in which rest the opposite ends

of the roller-spindles 2, as indicated at 2b. Thus one end of each roller 1 is capable of vertical movement. However, the spindles are restrained against rotary movement by fixing wires (not shown), by means of which the rollers 1 are linked together in pairs at their adjacent ends.

The main frame 7 of the feeder unit H also carries a pair of continuously rotating rollers or drums 8 and 9 which are mounted below the level of the conveyor rollers 1, for rotation about axes parallel to the axes of the latter. The drum 8 is driven by an electric motor 10, by way of a driving belt 11 and driving wheels 12 (Fig. 5) and 13. Around the drums 8 and 9 is trained a relatively narrow belt or band 14. Pressure on the band 14 is maintained by means of a spring loaded or counter-weighted roller 15 which is carried by a pivotable arm 16 and bears against the drum 8.

Normally the band 14 circulates just below the conveyor rollers 1, adjacent to the vertically movable ends thereof. However, it can be caused to bear against the rollers 1 by the operation of pressure means, comprising three elongated shoes 21, 22 and 23 are mounted in end-to-end relationship below the upper run of the band 14, so as to extend together along substantially the whole of the length of the set of rollers 1. The shoe 21, for instance, comprises a skid-plate 24 with two flanges 25 and 26 depending therefrom. By means of its flanges each shoe 21, 22 or 23 is mounted for pivotable movement about an axis 21a, 22a or 23a adjacent the end thereof which is nearer the discharge end of the feeder, that is to say, nearer the main belt B (Figs. 1 and 2) and remote from the conveyor bend F which delivers packages to the feeder. Thus each shoe is pivotable between the two positions shown, in the case of the shoe 21, by full lines and dotted lines in Fig. 4. By its pivoting movement, each shoe 21, 22 or 23 can press the corresponding part of the band 14 into contact with the rollers which lie above it. This causes the band 14 to drive the rollers 1 in rotation, by frictional engagement with the surfaces of the rollers, while the band 14 nevertheless continues to move relatively to the axes of the rollers 1 and relatively to the skid-plates of the shoes 21, 22 and 23. Meanwhile the vertically movable ends 2b of the rollers 1 yield slightly under the pressure exerted by the shoes 21, 22 and 23. By pivoting the shoes 21, 22 and 23 first upwardly towards the rollers 1 and then downwardly away from them, it is possible to apply driving power to the corresponding rollers and then to remove it therefrom, the rollers forming three separate groups for this purpose.

The pivoting movement of each pressure device or shoe 21, 22 or 23 is effected pneumatically by means of a corresponding cylinder and piston which operate under the control of the apparatus shown in Fig. 6, which apparatus includes poppet valves G1, G2, G3, H1, H2 and H3 controlling the supply of pressure medium (compressed air). Thus, in the case of the shoe 21 for instance, a piston 30 working in a cylinder 31 is mounted on a vertical piston rod 32, the free upper end 33 of which bears in a suitably shaped recess 34 formed in a member 35 extending transversely between the flanges 24 and 25 of the shoe 21. The supply of compressed air to the cylinder 31 is controlled by the valve H1 (Fig. 6), the air supply line connecting the cylinder 31 to the valve H1 and thence to compressor not being shown. When the valve H1 is opened, the piston 30 moves upwardly so that the shoe 21 pivots upwardly. When the valve closes, the piston 30 moves downwardly under the action of a restoring spring 35, with consequent downward pivoting of the shoe 21. The air line is fitted, between the valve H1 and associated cylinder 31, with an adjustable restrictor valve, by means of which the speed of operation of the corresponding shoe 21 can be varied as may be necessary.

The feeders G and H together have a total of six shoes and the control apparatus thereof has, as already mentioned, a corresponding number of valves G1, G2, G3, H1, H2 and H3. The opening and closing of each valve is effected by means of the corresponding one of six cams L1, L2, L3, M1, M2, and M3 which are mounted in different angular positions on a common continuously rotating cam-shaft 40. One complete rotation of the cam-shaft 40 corresponds to one operating cycle of the whole installation. The shape of the cams, and their angular disposition relatively to one another, is such that the three valves controlling the shoes of either feeder are opened simultaneously while, after the elapse of a certain time interval, the valves controlling the shoes of the other feeder unit are likewise opened simultaneously. On the other hand, the valves associated with each feeder are closed sequentially.

Considering now the feeder H, when it is inoperative, that is to say, when the shoes 21, 22 and 23 are in their lowered positions so that the band 14 does not drive the rollers 1, packages Q delivered by the corresponding packaging machine are impelled forwardly by the slats 101 of the associated conveyor bend F and by the transit rollers K and they accumulate on the rollers 1 of the feeder, each package delivered by the conveyor bend F pushing the preceding package forwardly across the rollers 1.

When the cam-shaft 40 reaches the position indicated in Fig. 6, in which the valves

H1, H2 and H3 controlling the feeder H are all open, the corresponding shoes 21, 22 and 23 pivot rapidly upwards into the positions shown in Fig. 4, so as to apply driving power to all the rollers 1 of the feeder, substantially simultaneously. As a result, the packages Q accumulated thereon commence to be fed across the ramp or flap J, on to the main conveyor B. However, the valve H1 immediately commences to close, so that the piston 30 begins to descend in its cylinder 31, under the action of its control spring. Thus the shoe 21 furthest from the main belt B commences to pivot downwardly into its inoperative position, to be followed by the intermediate shoe 22, under the control of the valve H2, and then by the shoe 23 nearest the main belt B, under the control of the valve H3.

The shapes of the control cams are such that, in contrast to the opening movement of the valves H1, H2 and H3 and the corresponding upward movement of the shoes 21, 22 and 23, the closing movement of the valves, and thus the downward movement of the shoes, is relatively slow. Accordingly, as each shoe 21, 22 or 23 pivots downwardly, the rollers 1 which it controls are released one by one from engagement with the driving band 14. The intermediate shoe 22 remains in its raised position until downward pivoting of the shoe 21 has been completed and the shoe 23 remains in its raised position until both the other shoes 21 and 22 have been restored to their inoperative positions. In this way, driving power is removed from the rollers 1 sequentially so that, as soon as the last package Q of the batch has been discharged from the feeder H, all the rollers 1 of the feeder are again at rest. The next package arriving at the input end of the feeder will not be fed forwardly across the rollers 1 of the feeder. It will be impelled on to the feeder by the action of the slats of the conveyor bend F and of the transmit rollers K, but as soon as it becomes disengaged from the latter it will come to rest, until displaced by the next package supplied by the packaging machine.

Meanwhile, the cam-shaft 40 will have rotated into the position in which the cams L1, L2 and L3 open the corresponding valves G1, G2 and G3 so that the operating shoes (not shown) of the feeder G are pivoted into their operative positions, in a manner similar to that described above in connection with the feeder H. In this way a batch of packages P is discharged to upper flight A of the main belt B, at the lower end thereof, and is carried upwardly, the discharge ramp J being deflected to allow the passage thereof.

When the feeder H again becomes operative, a further bath Q is delivered to the main belt B and, in this way, a stream of batches of packages derived alternately from one and the other packaging machine is formed on the main conveyor B. Since the slats of the conveyor bends E and F and the associated transit rollers K (Fig. 4) are driven continuously, even when their associated feeders G and H are idle or inoperative, the packages accumulated on the rollers of the feeder G or H are in close contact with one another. In cases where the packages handled are of uniform size and all reach the feeders G and H in substantially the same dispositions, the overall length d of the feeders G and H may conveniently be equal to the overall length of the maximum number of packages which it is intended should be included in any batch.

As an example of a particular practical case, mention may be made of an installation constructed in accordance with the invention and intended for forming a stream of batches of rectangular packages, each package being 10″ long. In this particular case, the packages are supplied by two packaging machines each delivering a maximum of twenty-four packages per minute and it is intended that each batch should include five packages. Each feeder G or H is therefore 4′ 2″ long, corresponding to the overall length of an accumulated batch of five packages.

The linear speed of the driving bands 14 of the feeders G and H, and thus the speed at which packages are fed by the feeders when operative, is 67 feet per min., so that the time taken to deliver a batch of five packages to the main conveyor is $4\frac{1}{2}/67$ mins. $= 3\frac{3}{4}$ secs. approximately. The speed of the main conveyor B is 100 feet per min., so that during the time taken for the delivery of the batch to the main conveyor B, the latter moves through $100 \times 3\frac{3}{4}$ ft. $= 6'\ 3''$.

$$\frac{}{60}$$

Thus each batch of five packages is distributed over that distance on the main conveyor B. That is to say, the spacing between the individual packages of each batch is $6\frac{1}{4}''$.

Once a complete batch of five packages has been delivered to the main belt by either feeder G or H, a period of $12\frac{1}{2}$ secs. will elapse before a further complete batch has been accumulated by that same feeder, from the corresponding packaging machine. During this time the main conveyor belt B moves through $100 \times 12\frac{1}{2}$ ft. $= 20'\ 10''$. Since

$$\frac{}{60}$$

the packages of each batch are distributed over a distance of 6′ 2″ on the main conveyor B, the distance between the end of one batch and the beginning of the next successive batch derived from the same

packaging machine is 20' 10" – 6' 3" = 14' 7". The intermediate batch delivered from the other packaging machine will be located in that interval and, assuming that the arrangement is such that the combined stream is to consist of equally spaced batches, the spacing between the end of a batch derived from one packaging machine and the beginning of the succeeding batch derived from the other packaging machine should be 4' 3½". This distance, together with the distance between the points C and D, at which the two feeders G and H discharge packages to the main conveyor B, and the speed of the latter, determine the time interval which has to elapse between the two feeders being rendered operative, the cams L1, L2, L3, M1, M2, and M3 being set accordingly.

The time which elapses between the simultaneous application of driving power to all the rollers 1 of one feeder G or H and the termination of the sequential removal of driving power therefrom must be equal to the time taken to feed a batch of five packages to the main belt, that is to say 3½ secs. Thus, the arrangement has to be such that each shoe takes 1½ secs. to complete its downward pivoting. Moreover, while the shoe furthest from the main belt (the shoe 21 in the case of the feeder H) remains in its uppermost position only momentarily, the intermediate shoe (22) and the shoe (23) nearest the main conveyor B dwell in their uppermost positions for periods of 1½ secs. and 2½ secs. respectively.

It will be understood that the details of this practical case have been given only in order to indicate the relationship between the various factors involved and are not to be regarded as being limitative in any way.

WHAT WE CLAIM IS:—

1. Article-feeding apparatus comprising a roller conveyor having conveyor rollers which are adapted to be rotatably driven so as to convey articles supported thereby, means for delivering articles to said rollers for conveyance therealong and cyclically operating means for driving the rollers selectively and intermittently in such a way that an article or articles delivered to the rollers at the commencement of each operating cycle is or are fed forwardly by the rollers, while an article or articles subsequently delivered by the delivery means to the rollers is not or are not fed until the commencement of the next operating cycle.

2. Apparatus as claimed in Claim 1, wherein the arrangement of the cyclic operating or driving means is such that a number of the said rollers, adjacent the delivery means, are driven at the commencement of each operating cycle but remain at rest during the remainder of the operating cycle.

3. Apparatus as claimed in Claim 1, wherein the arrangement of the cyclic driving means is such that driving power is applied to all the rollers, substantially simultaneously, at the commencement of each operating cycle but is subsequently removed from the rollers progressively, commencing with the roller nearest the delivery means.

4. Apparatus as claimed in Claim 1, wherein the cyclic driving means includes a continuously circulating band which extends, over a part of its length, in position to be caused, by pressure means, to bear against the rollers, or against selected ones thereof, so as to drive them by frictional contact therewith.

5. Apparatus as claimed in Claim 4, wherein the pressure means includes at least one elongated shoe which extends along a part of the length of the said band, which shoe is mounted for pivotal movement, towards and away from the rollers, about an axis adjacent the end thereof which is remote from the delivery means, so as to be adapted to cause driving power to be applied to and removed from the rollers by its pivoting movement towards and away from the latter.

6. Apparatus as claimed in Claim 4, wherein the pressure means includes a plurality of pressure devices which are adapted to cause the band to bear against and drive corresponding ones of the said rollers.

7. Apparatus as claimed in Claim 6, wherein each pressure device comprises an elongated shoe, the said shoes together extending in end-to-end relationship along substantially the whole of that part of the length of the band which is adapted to bear against the rollers, and wherein each shoe is mounted for pivotal movement, towards and away from the rollers, about an axis adjacent the end thereof which is remote from the delivery means, so as to be adapted to cause driving power to be applied to and removed from the corresponding rollers by its pivoting movement towards and away from the latter.

8. Apparatus as claimed in Claim 6 or Claim 7, wherein the cyclic driving means includes, for each pressure device, a piston and cylinder which are movable relatively to one another so as to actuate and release the said pressure devices.

9. Apparatus as claimed in Claim 8, wherein relative movement of each said piston and cylinder, to cause the corresponding pressure device to apply driving pressure, takes place under the action of pressure-medium supplied to the cylinder by way of a corresponding control valve.

10. Apparatus as claimed in Claim 8 or Claim 9, wherein relative movement of each said piston and cylinder, to cause driving pressure to be withdrawn by the correspond-

ing pressure device, takes place under the action of a biasing spring.

11. Apparatus as claimed in Claim 9, wherein the cyclic driving means further includes means for operating the said control valves cyclically.

12. Apparatus as claimed in Claim 11, wherein the valve-operating means includes an operating cam for each valve, the cams being mounted on a common continuously rotating shaft.

13. A conveyor installation, comprising a conveyor, two article-feeding apparatus as claimed in any of Claims 1 to 10, arranged so as to feed articles to the conveyor at points spaced from one another along the length thereof, and means controlling the cyclic driving means of the two feeding apparatus, so that articles or batches of articles fed by the latter to the conveyor together form on the said conveyor a stream of articles or batches of articles, derived alternately from one and the other of the said feeding apparatus.

14. An installation as claimed in Claim 13, wherein the said conveyor is inclined, wherein the two feeding apparatus are arranged at different vertical levels along the conveyor and wherein one of the said feeding apparatus delivers articles or batches of articles to the conveyor by way of a ramp, which is adapted to be deflected to allow the passage of articles or batches of articles fed to the conveyor by the other feeding apparatus,

15. An installation as claimed in Claim 14, wherein the conveyor is an endless-belt conveyor, and wherein the feeding apparatus are arranged to deliver articles or batches of articles to the ascending flight thereof.

16. An installation as claimed in any of Claims 13 to 15, each as appendant to Claim 9, which includes means for operating the control valves of the two feeding apparatus in a single common cycle.

17. An installation as claimed in Claim 16, wherein the valve-operating means includes a cam for each of the valves of the two feeding apparatus, all the cams being mounted on a common continuously rotating shaft.

18. Article-feeding apparatus, substantially as herein described with reference to Figs. 4 and 5 of the accompanying drawings.

19. A conveyor installation, substantially as herein described with reference to Figs. 1 to 6 of the accompanying drawings.

Agents for the Applicants,
STANLEY, POPPLEWELL, FRANCIS & ROSS,
Chartered Patent Agents,
Cursitor House,
9—11 Cursitor Street,
Chancery Lane,
London, E.C.4.

Abingdon : Printed for Her Majesty's Stationery Office, by Burgess & Son (Abingdon), Ltd.—1962.
Published at The Patent Office, 25, Southampton Buildings, London, W.C.2,
from which copies may be obtained.

Fig. 1.

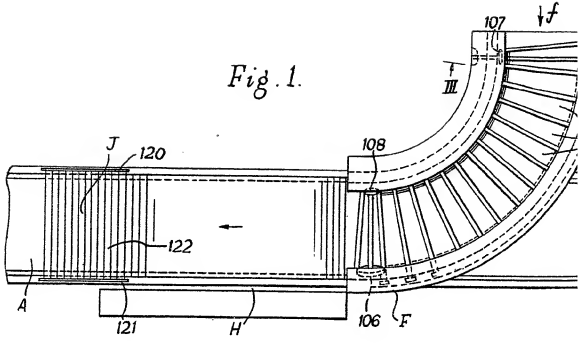
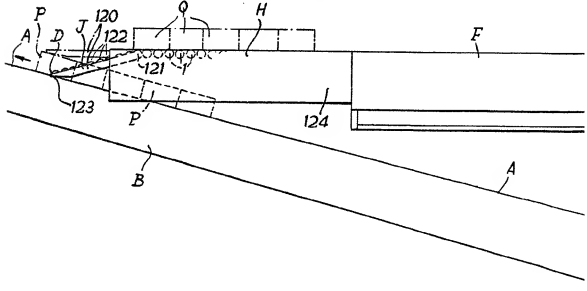

107
f
III
J
120
108
122
A
121
H
106
F

Fig. 2.

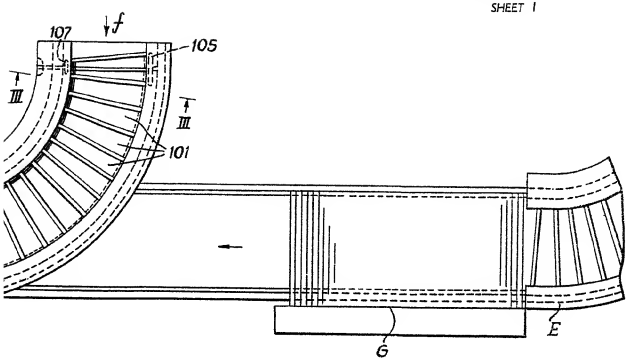

P
A
D
J
120
122
Q
H
F
121
123
P
124
B
A

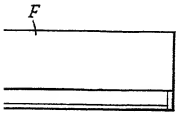
912,637 COMPLETE SPECIFICATION

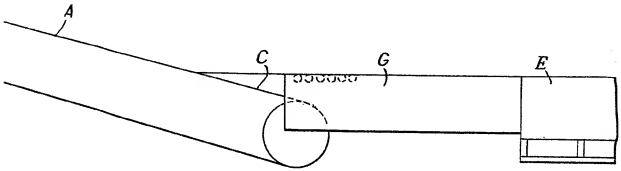
3 SHEETS

This drawing is a reproduction of the Original on a reduced scale.

SHEET 1







912,637 COMPLETE SPECIFICATION
3 SHEETS This drawing is a reproduction of the Original on a reduced scale.
SHEET 1

Fig. 1.

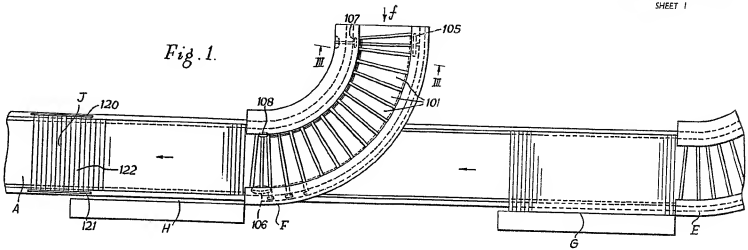


Fig. 2.

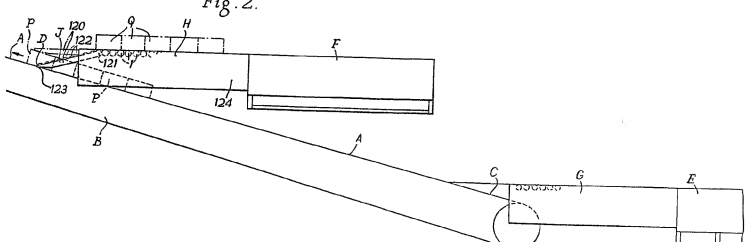


Fig. 3.

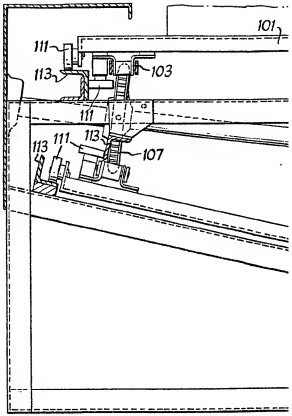
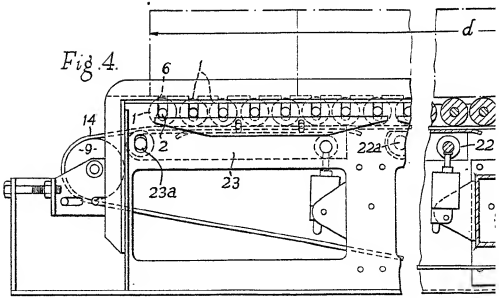
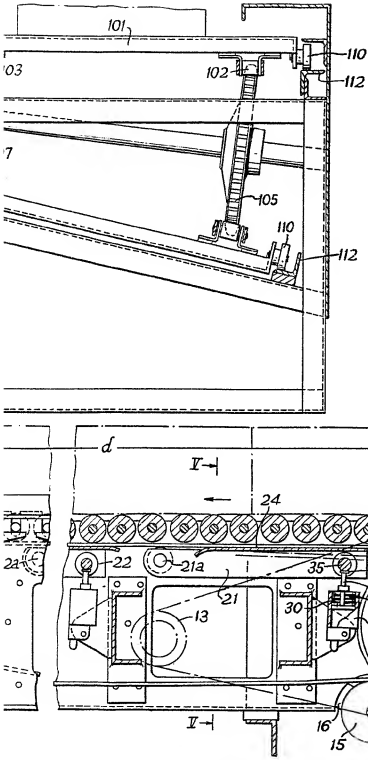


Fig. 4.



912,637 COMPLETE SPECIFICATION
3 SHEETS
This drawing is a reproduction of the Original on a reduced scale.
SHEET 2



912,637 COMPLETE SPECIFICATION
3 SHEETS This drawing is a reproduction of the Original on a reduced scale.
SHEET 2

Fig. 3.

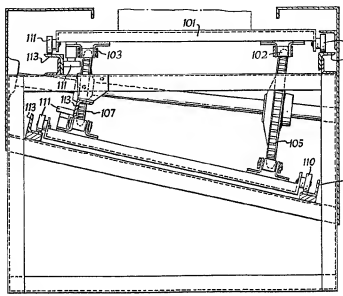
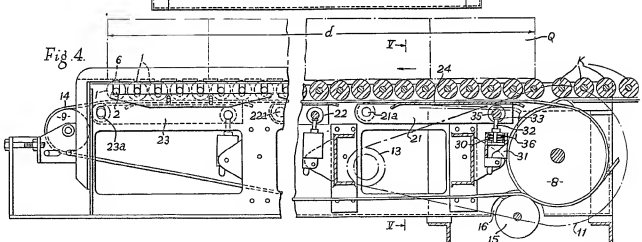


Fig. 4.



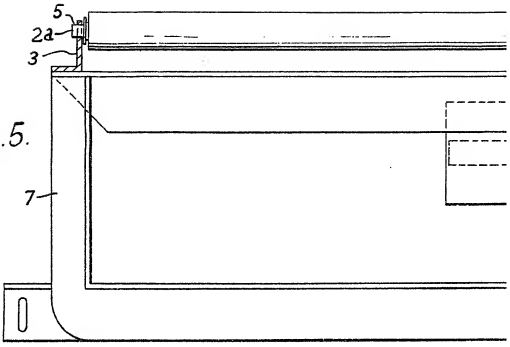
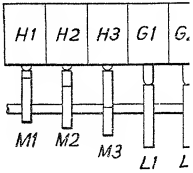


Fig.5.

Fig.6.



912,637 COMPLETE SPECIFICATION
3 SHEETS
This drawing is a reproduction of the Original on a reduced scale.
SHEET 3

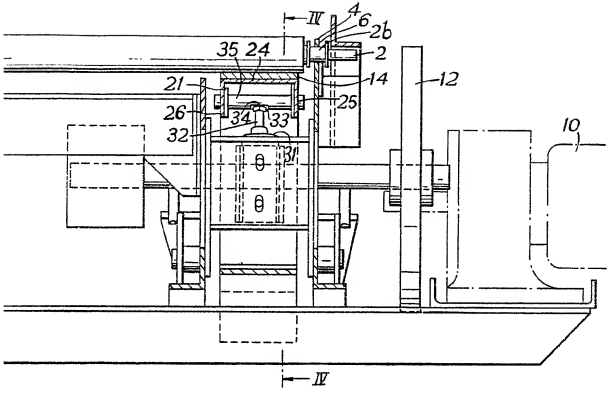
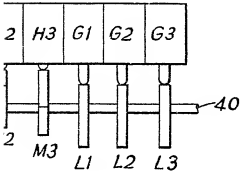


Fig. 6.



912,637 COMPLETE SPECIFICATION
3 SHEETS This drawing is a reproduction of the Original on a reduced scale.
SHEET 3

Fig.5.

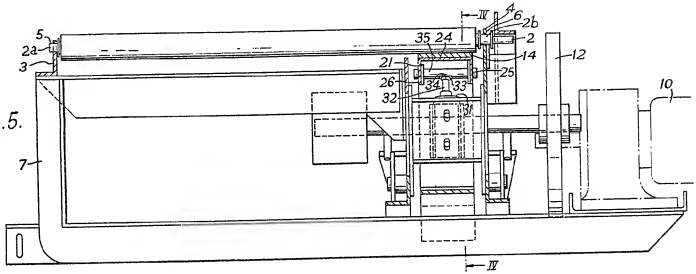


Fig.6.